WATER FOLLIES

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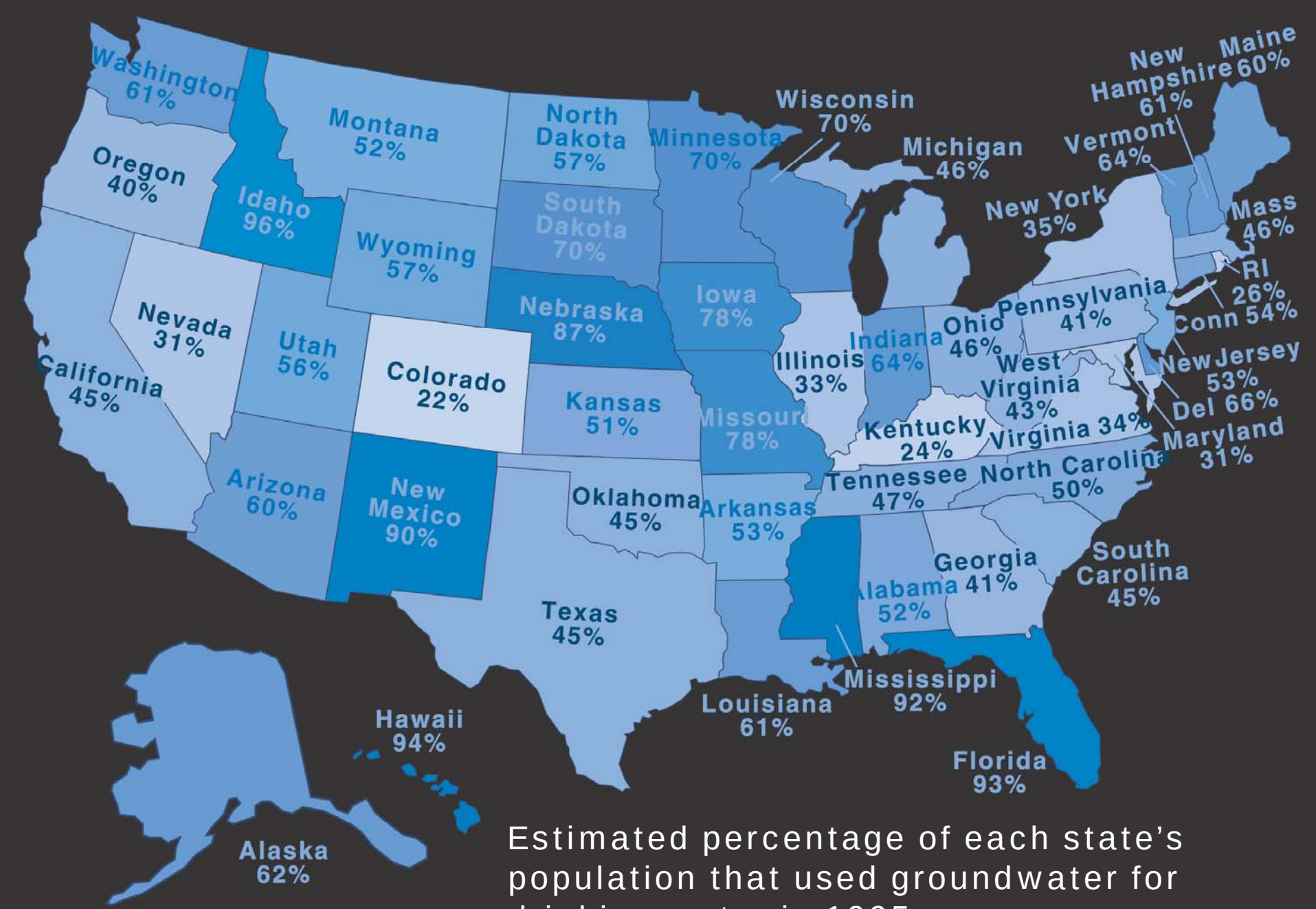
Groundwater Use Has Skyrocketed

- for domestic purposes alone:
  - from 8 billion gallons per day (bgd) in 1965 to 19.7 bgd in 2000
  - or, 69 gallons for every man, woman, and child in the country
- in 2000, mining industry pumped 740 billion gallons
- farmers use 2/3 of all groundwater pumped
- total groundwater use in 2000: 30 *trillion* gallons
- groundwater constitutes more than 25% of nation's water supply
- over 1/2 of U.S. population relies on groundwater for drinking water supply



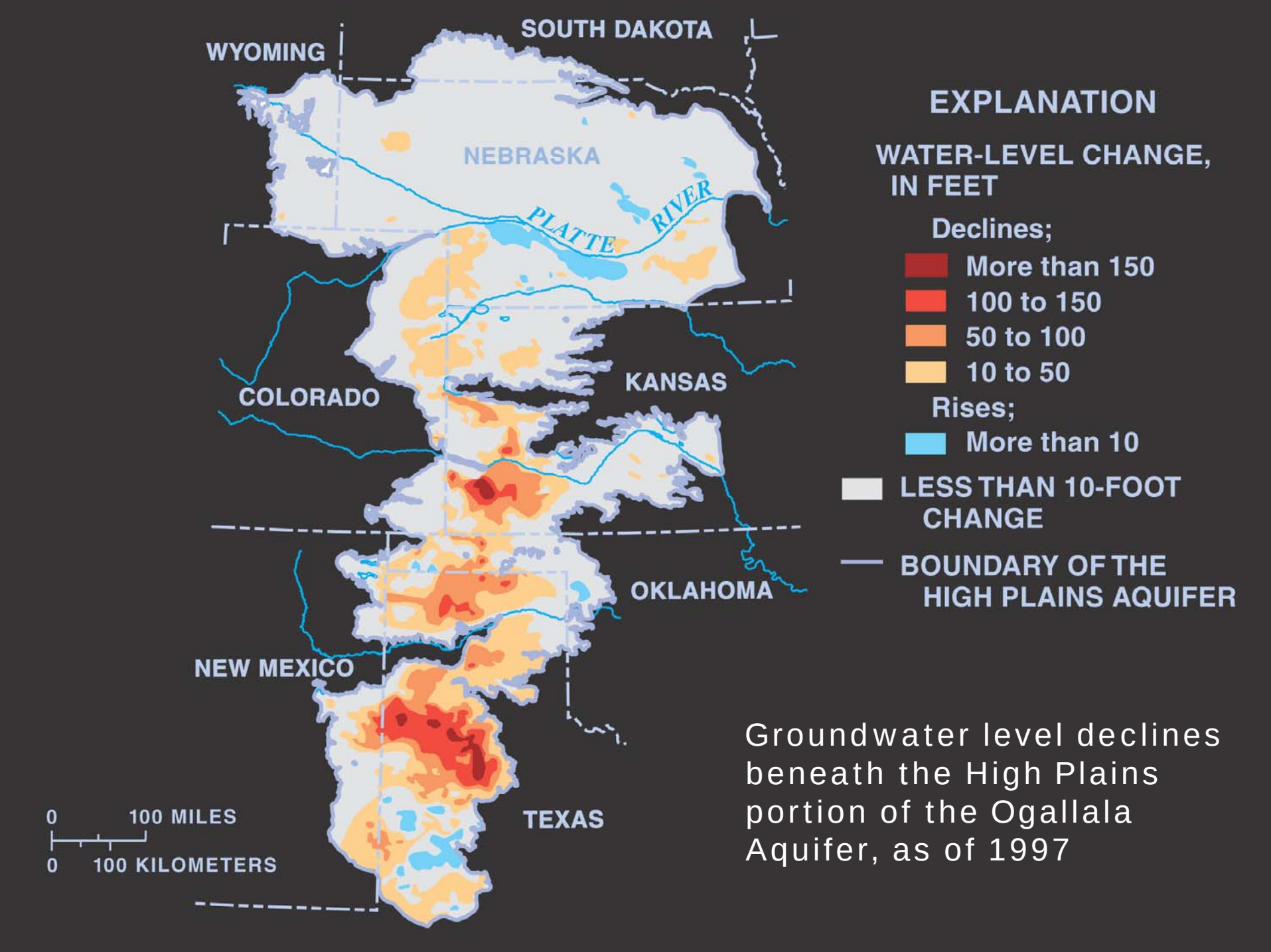
Estimated percentage of each state's population that used groundwater for drinking water in 1995

Water Law

- Surface Water
  - Riparianism
    - in eastern United States
    - owners of land abutting lakes and rivers
    - “correlative” rights – reasonable share
  - Prior Appropriation
    - in western United States
    - “first-in-time” is “first-in-right”
    - specific quantity with specific priority date

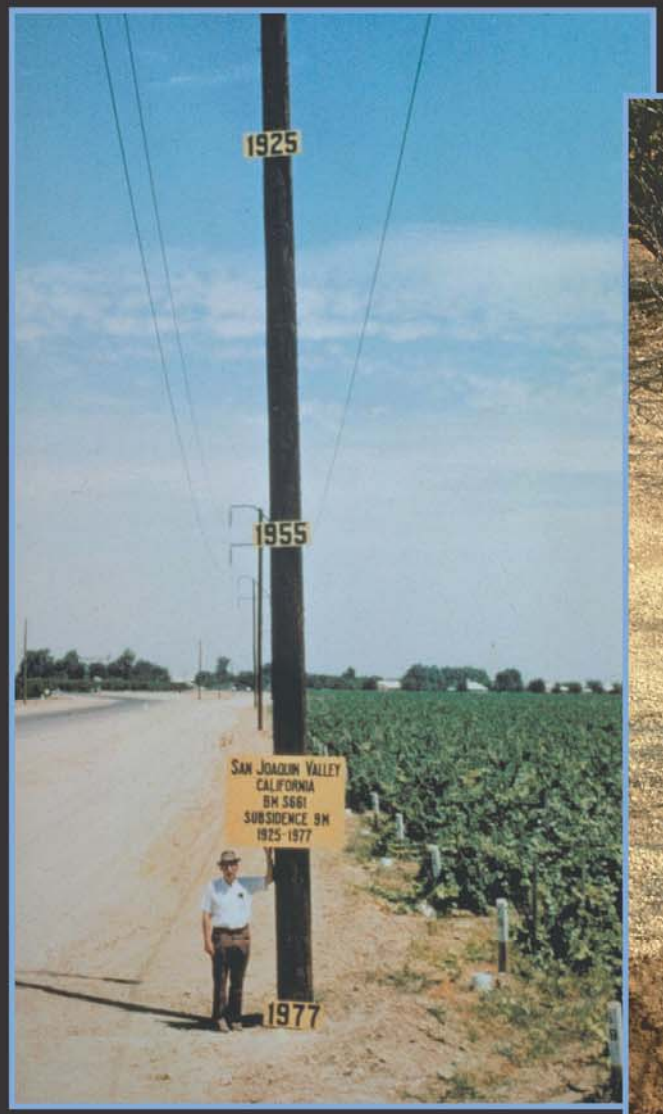
- Groundwater
  - right of capture (a few states)
  - reasonable use (most states)
  - prior appropriation (protection against subsequent pumpers)
- Problems with groundwater law

1. Capture and reasonable use allow overdrafting or “mining” the resource.
2. Consequences of mining groundwater
   - eventually exhaust supply

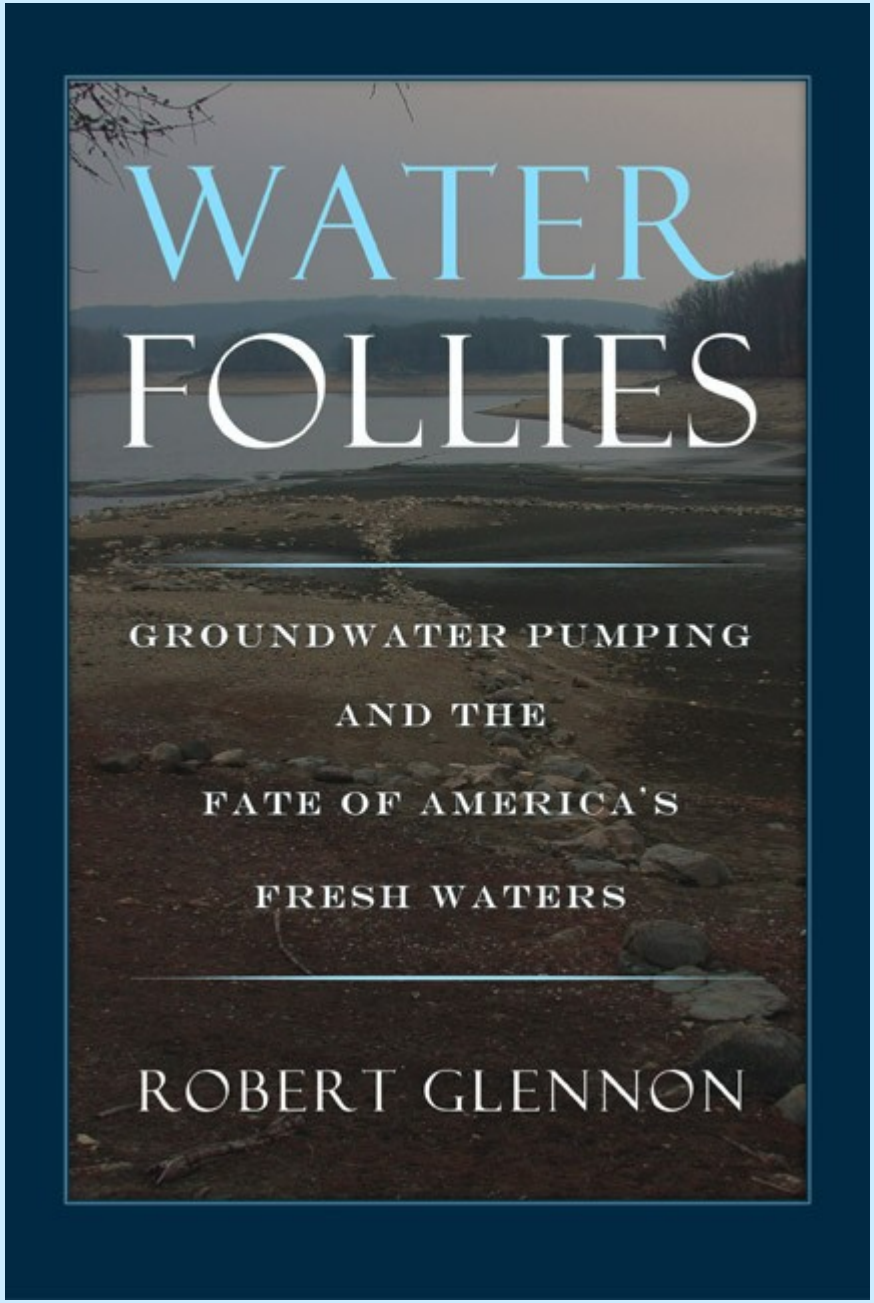


Groundwater level declines beneath the High Plains portion of the Ogallala Aquifer, as of 1997

- increased energy costs
- decreased water quality
- salt water intrusion
- subsidence



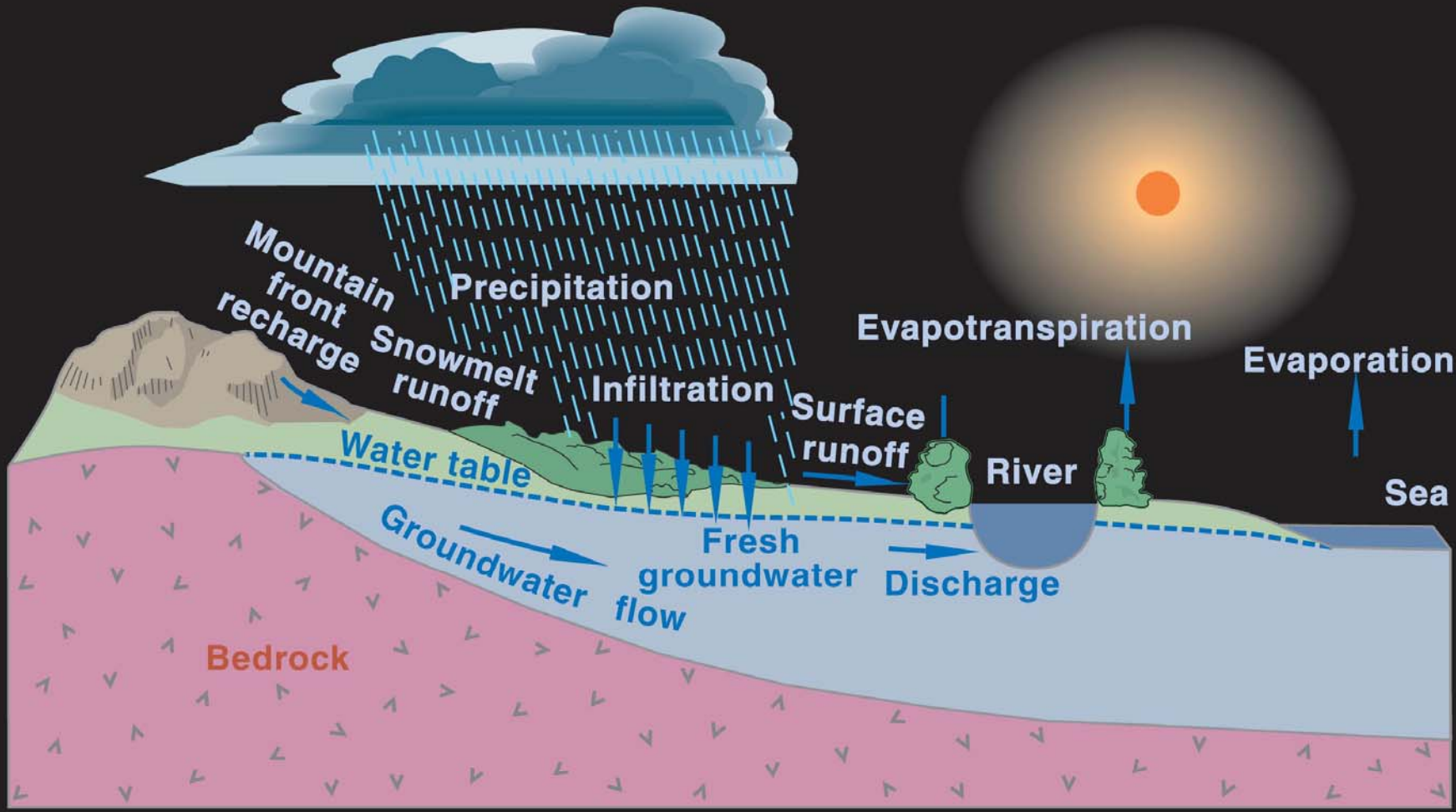
Land subsidence in the San Joaquin Valley of California.
Subsidence fissure in Pinal County, Arizona.
Road sign in Pinal County, Arizona


WATER
FOLLIES
GROUNDWATER PUMPING
AND THE
FATE OF AMERICA'S
FRESH WATERS
ROBERT GLENNON

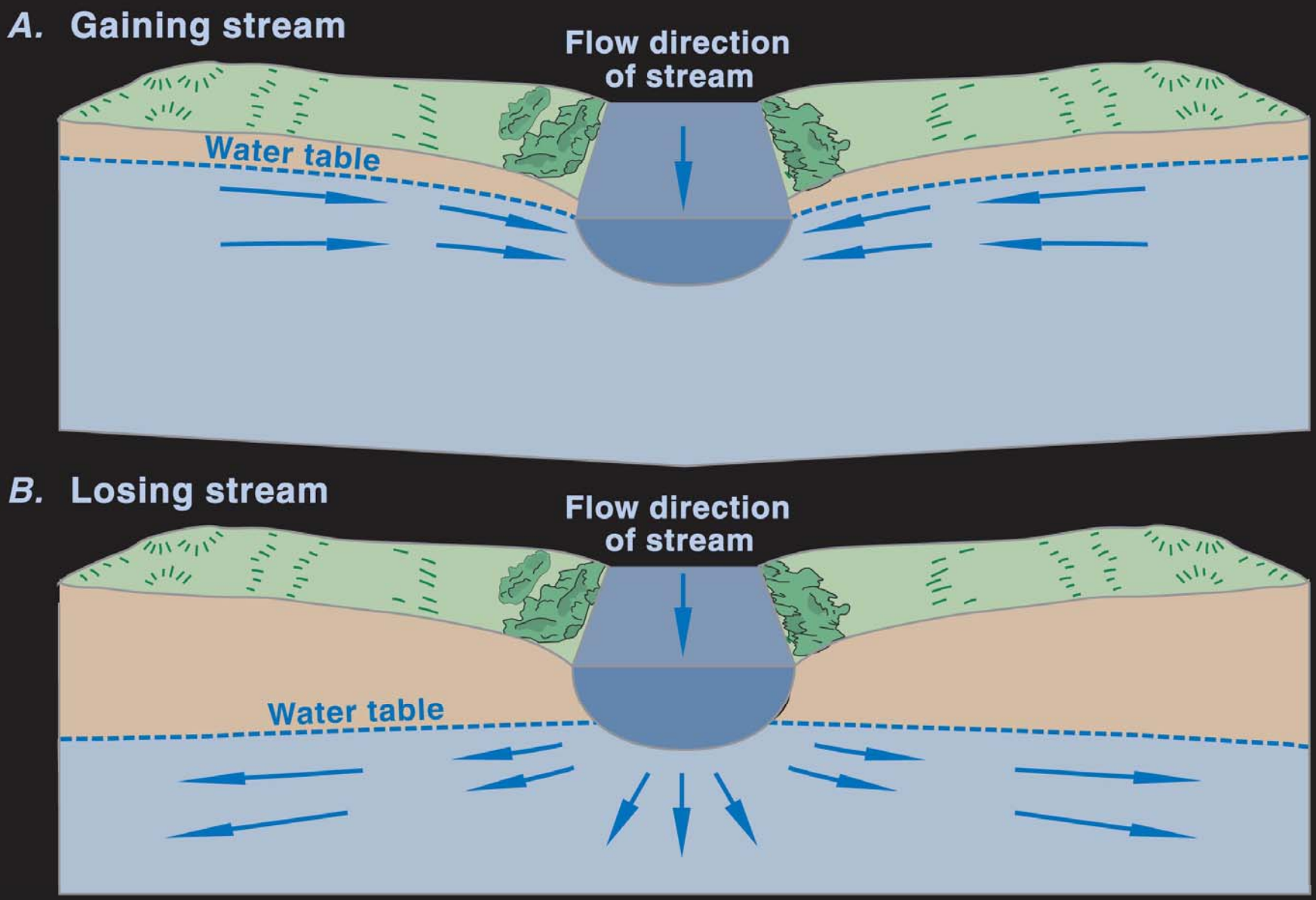
The upper Santa Cruz River basin in southern Arizona


1942
The Santa Cruz River

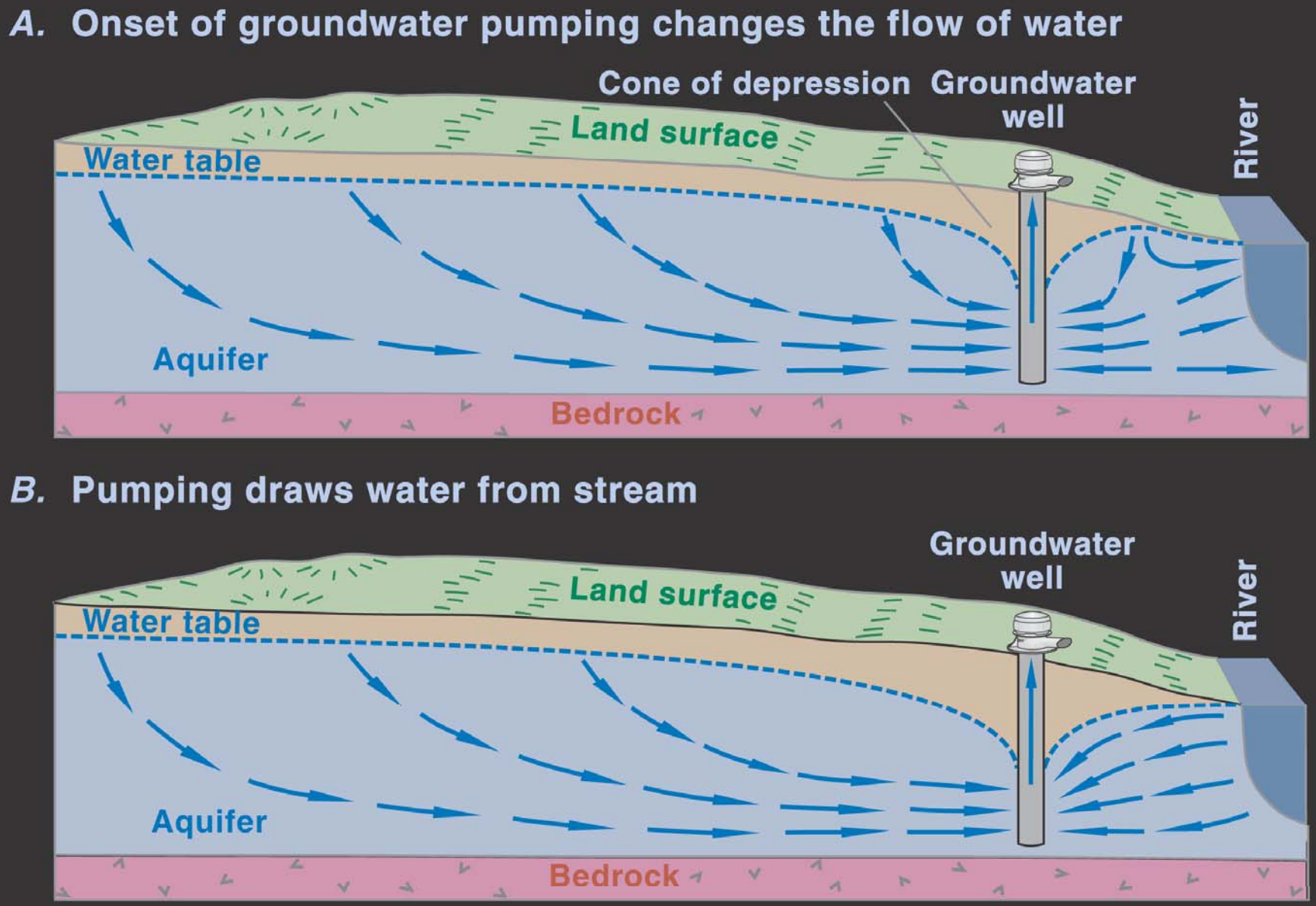

1989
The Santa Cruz River



The Hydrologic Cycle

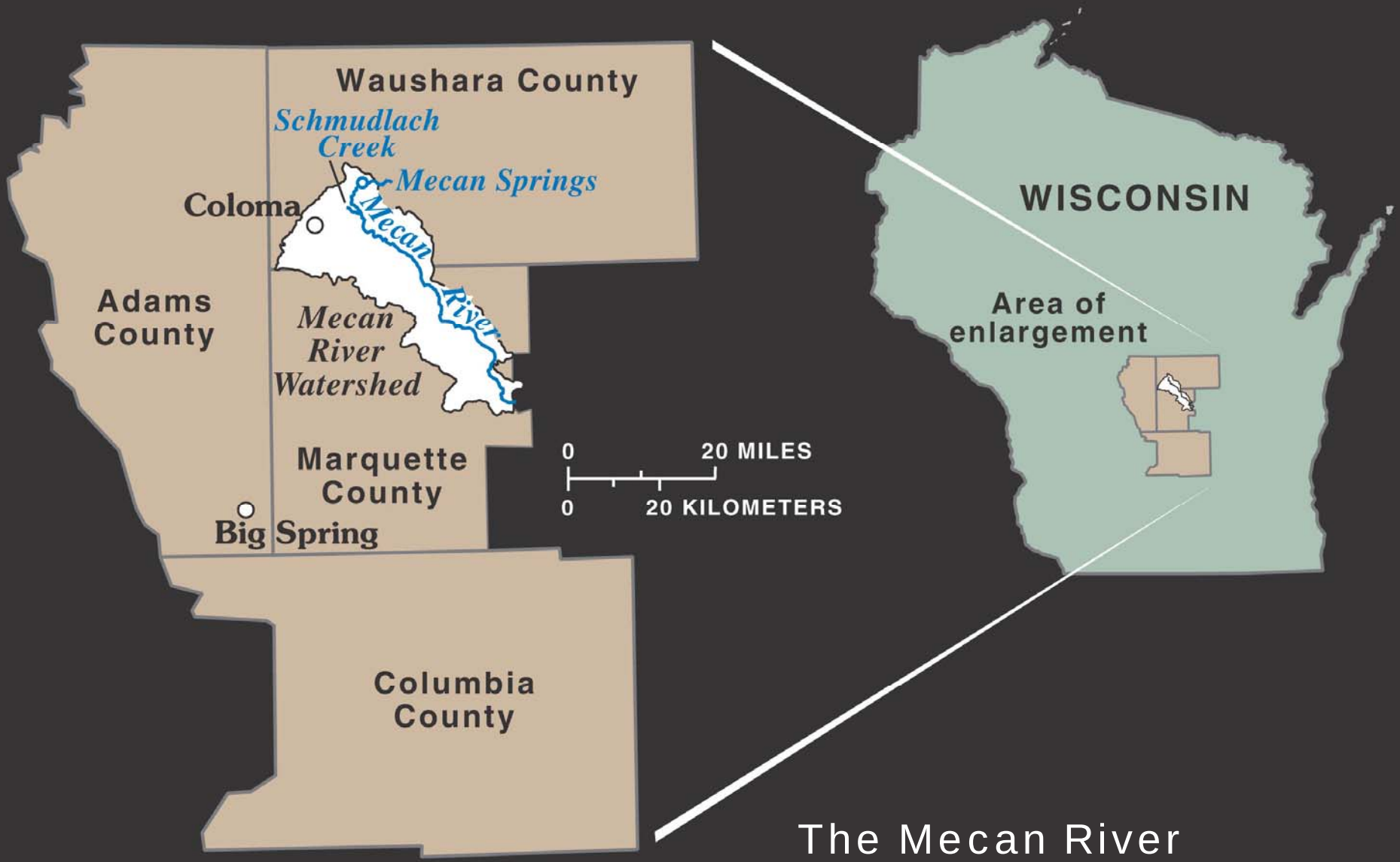


In a gaining stream (A), water discharges from the surrounding soil into the stream, but in a losing stream (B), water infiltrates the ground.

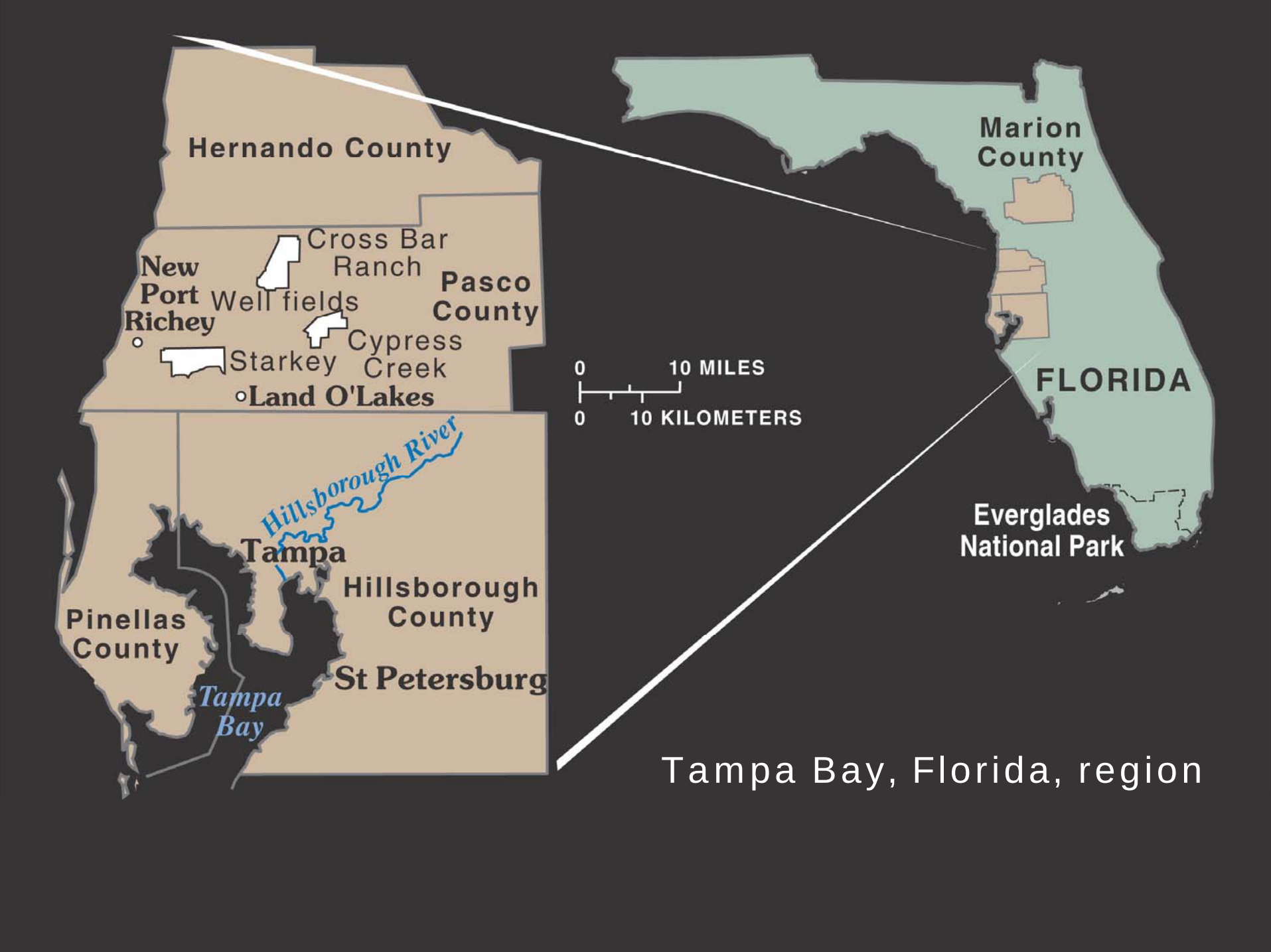

A. Onset of groundwater pumping changes the flow of water
Cone of depression
Groundwater well
Land surface
River
Water table
Aquifer
Bedrock
B. Pumping draws water from stream
Groundwater well
Land surface
River
Water table
Aquifer
Bedrock

The upper San Pedro River in Southern Arizona

The San Pedro River



The Mecan River watershed of Wisconsin

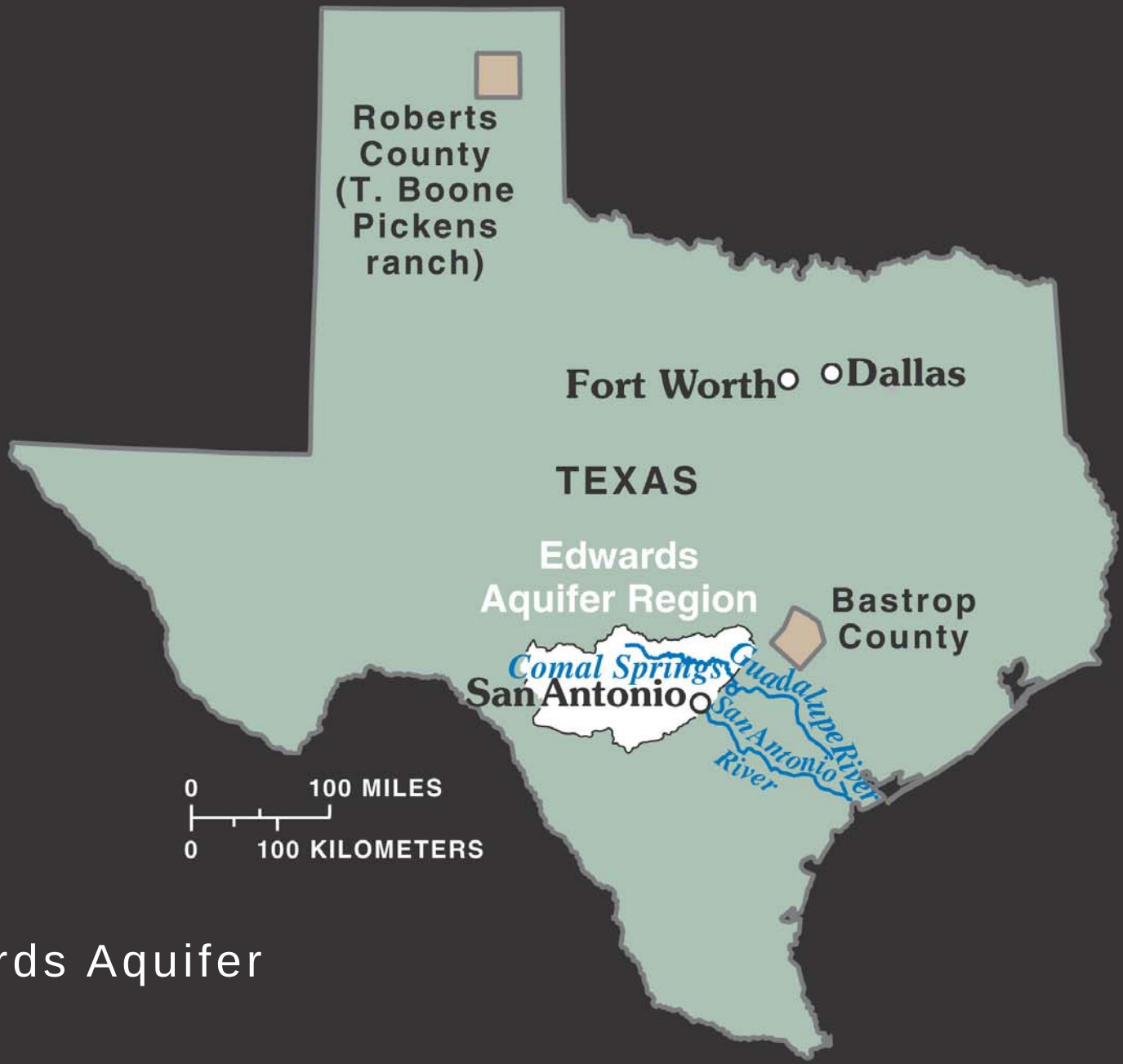


Tampa Bay, Florida, region

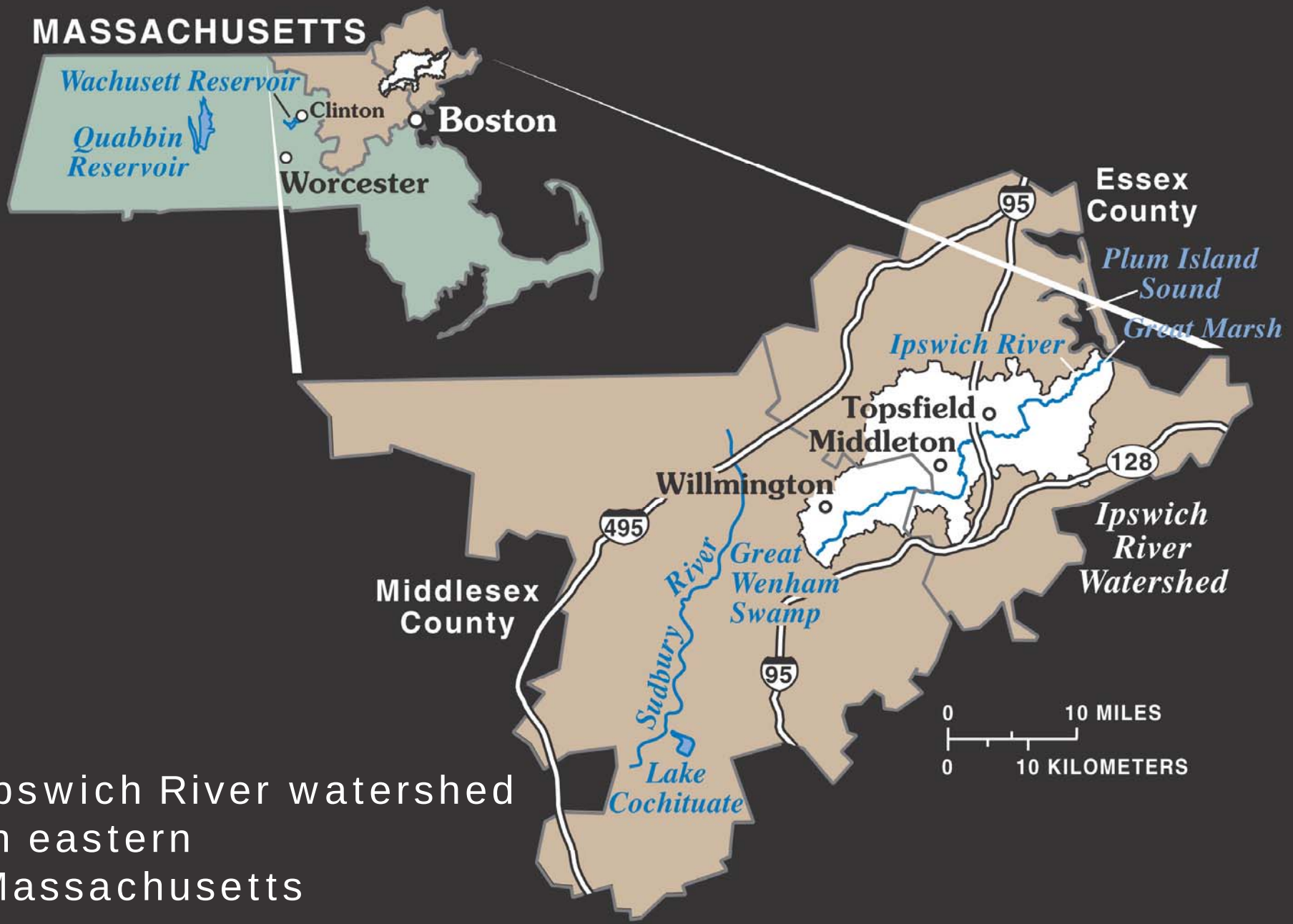
Sinkhole in west-central Florida caused by groundwater pumping

Crooked Lake in
central Florida

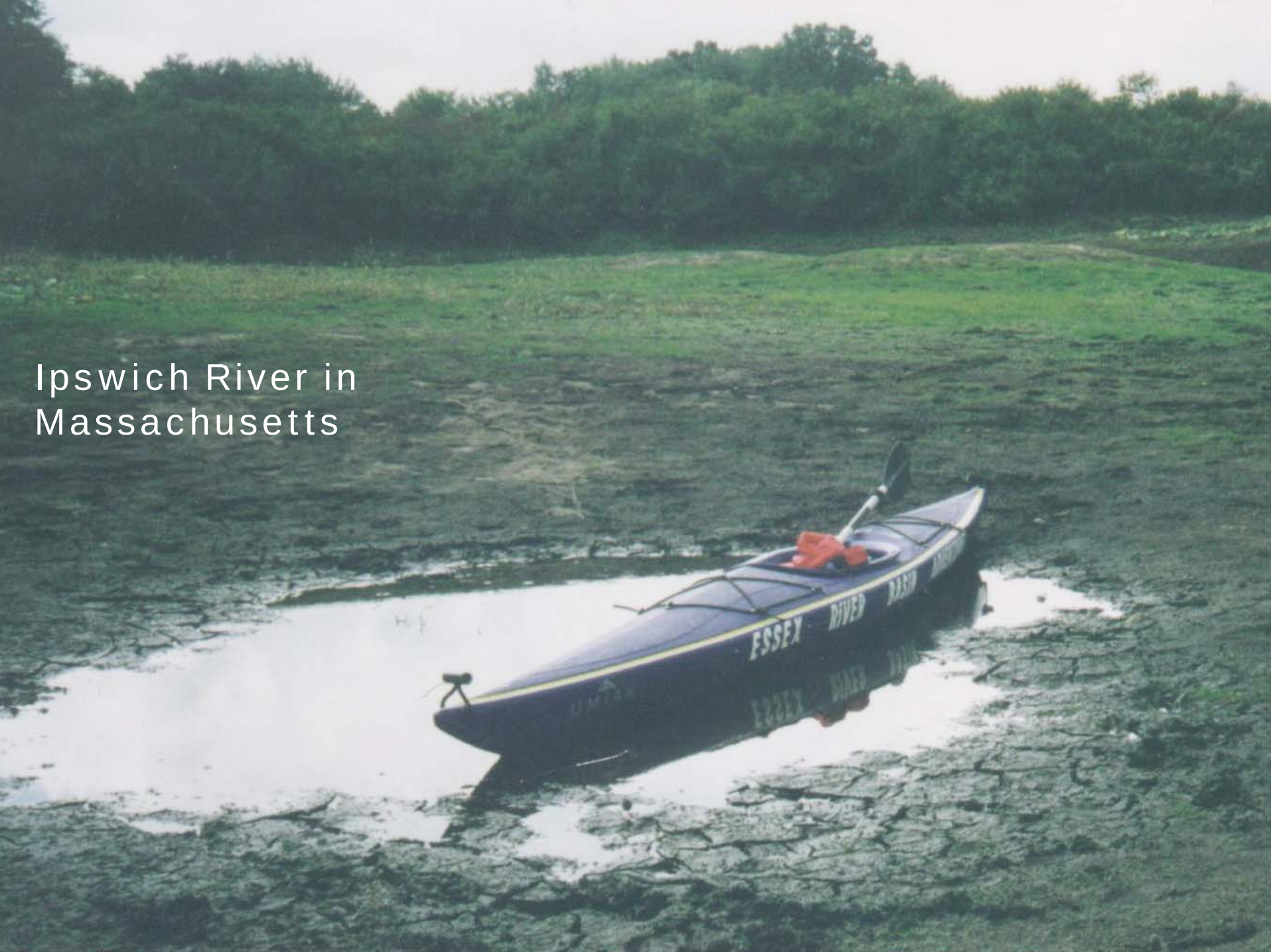
Crooked Lake in central Florida



The Edwards Aquifer
in Texas



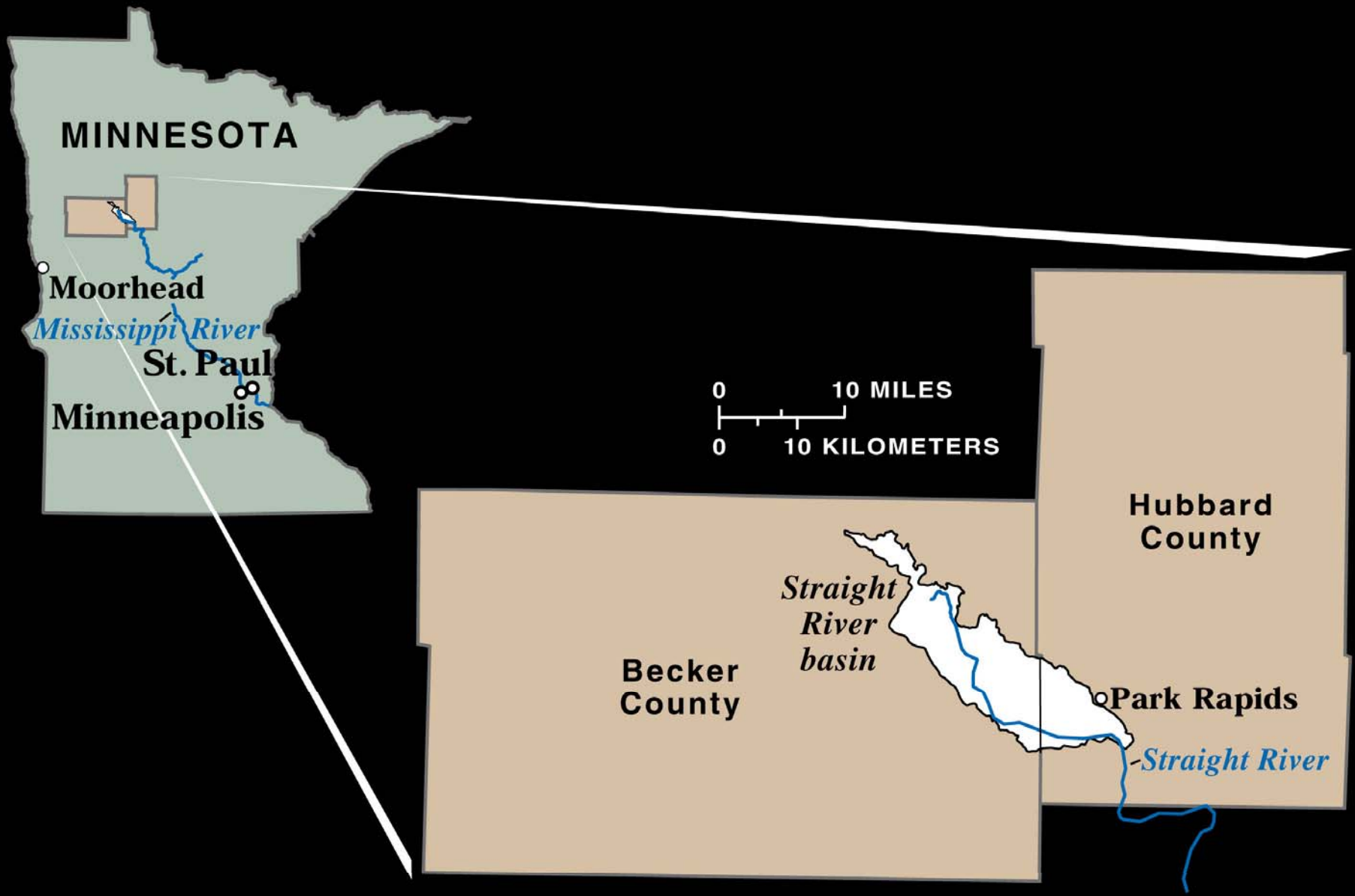
Ipswich River watershed in eastern Massachusetts



Ipswich River in Massachusetts

The Consumnes River region in north-central California

Blueberry-growing regions of Maine and rivers with wild Atlantic salmon



The Straight River in Minnesota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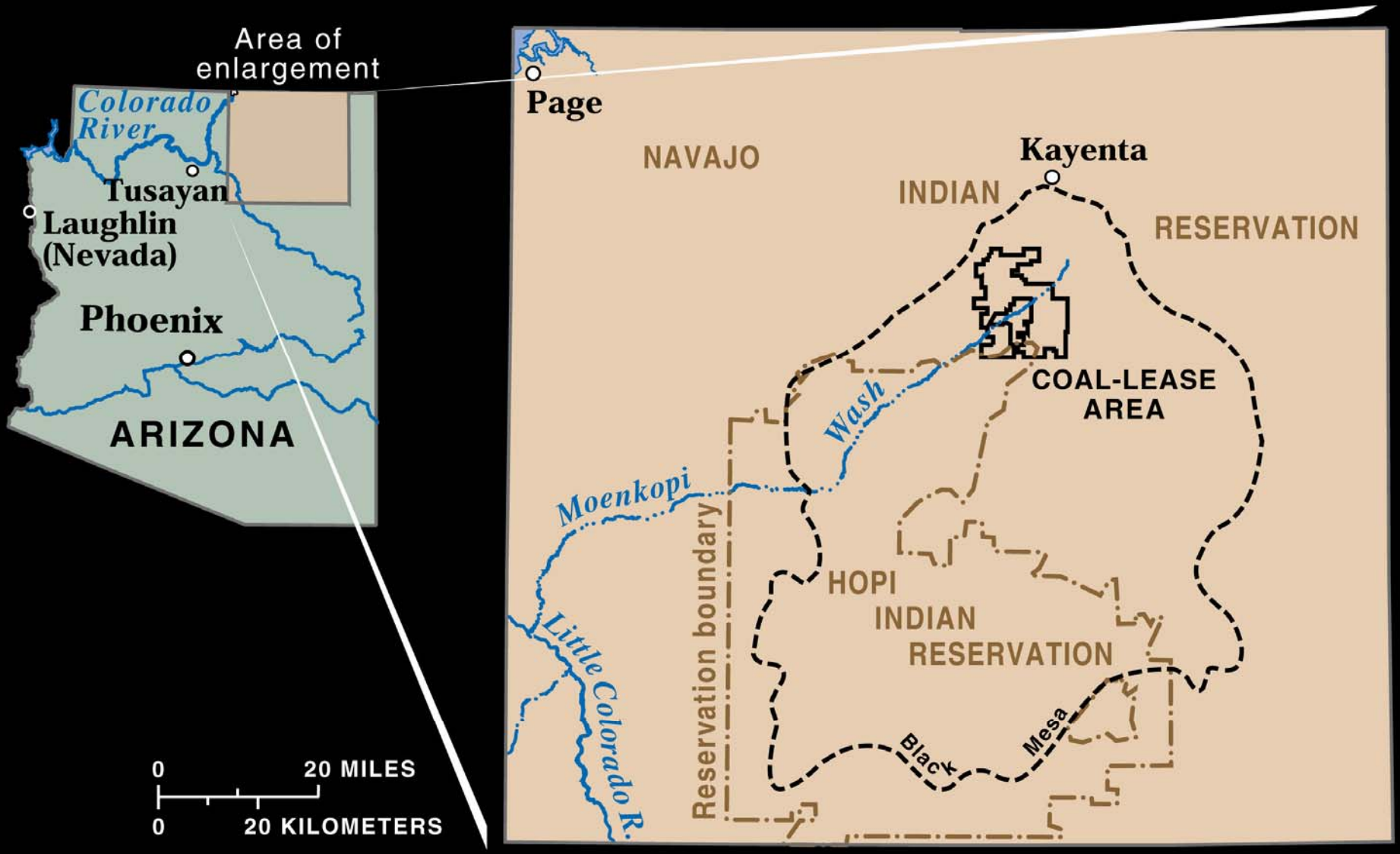
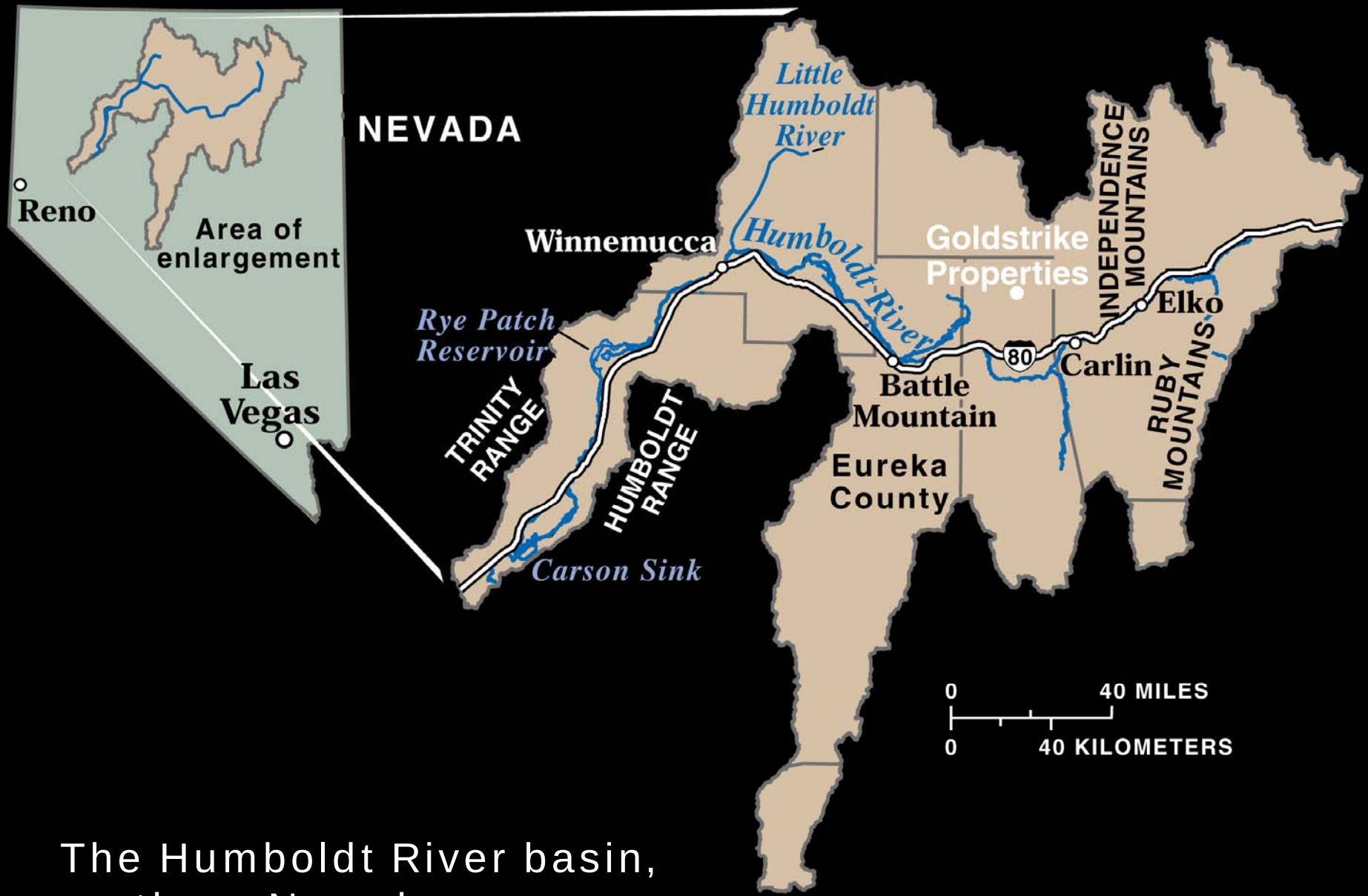
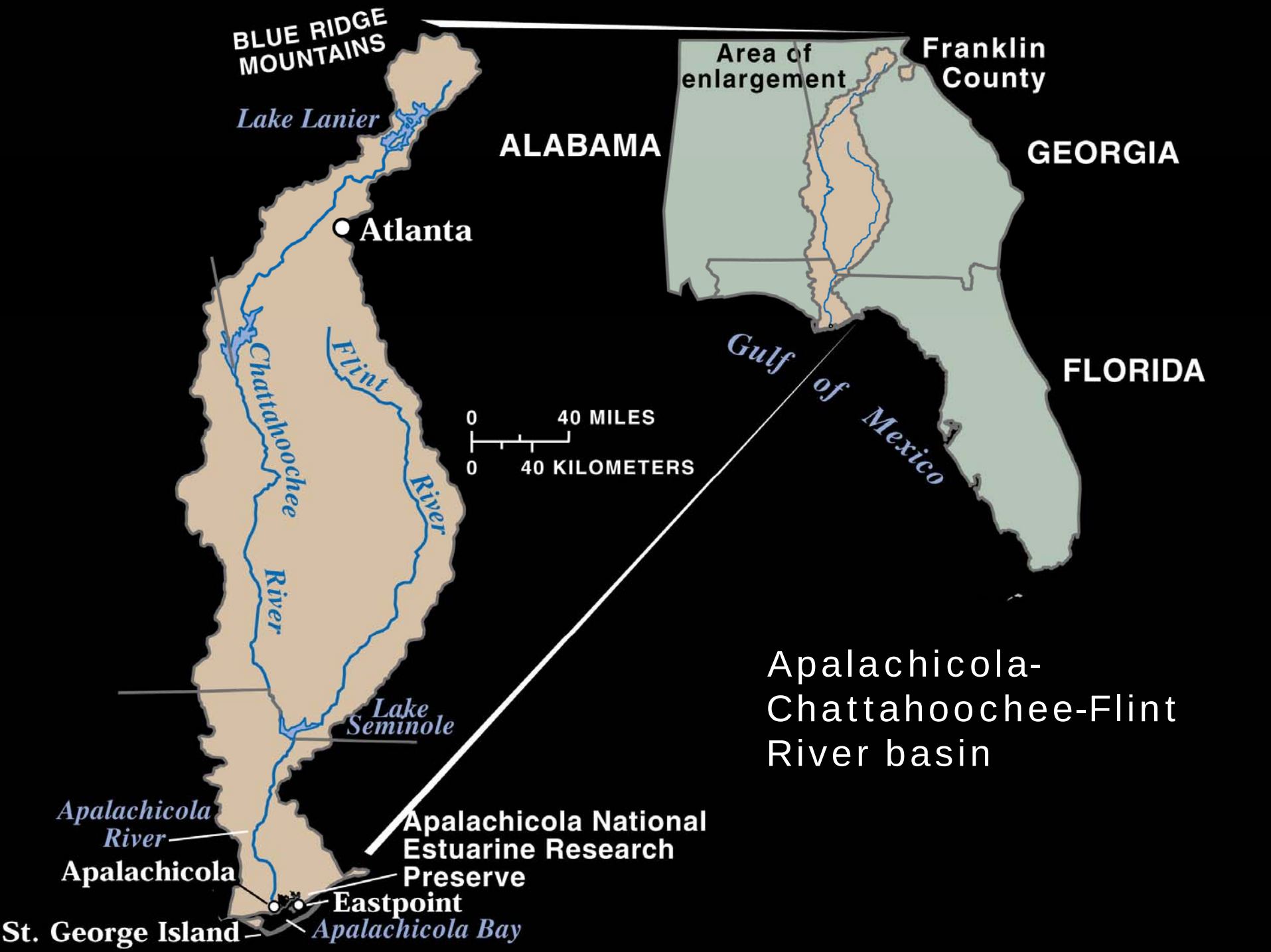
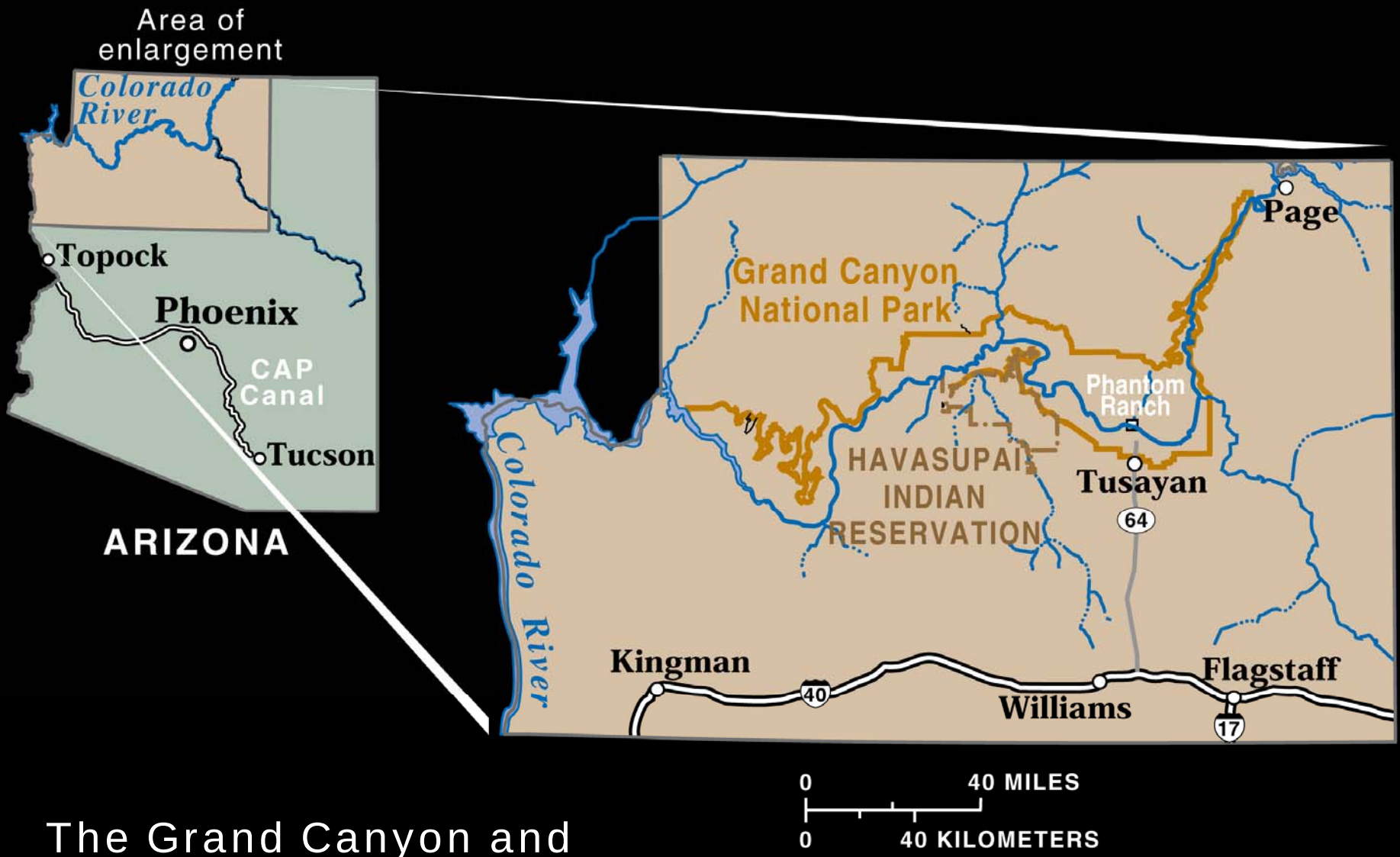


The Black Mesa area of northeastern Arizona



The Humboldt River basin, northern Nevada


BLUE RIDGE MOUNTAINS
Lake Lanier
ALABAMA
Atlanta
Area of enlargement
Franklin County
GEORGIA
FLORIDA
Gulf of Mexico
Chattahoochee River
Flint River
0 40 MILES
0 40 KILOMETERS
Lake Seminole
Apalachicola River
Apalachicola
Apalachicola National Estuarine Research Preserve
Eastpoint
St. George Island
Apalachicola Bay
Apalachicola-Chattahoochee-Flint River basin



The Grand Canyon and vicinity in northern Arizona

The Problem and the Solution

The Problem:

- population growth
- appalling waste
- Tragedy of the Commons
    - unlimited access to “common pool” resource
    - legal rules (“right of capture” and reasonable use) encourage exploitation
- gap between law and science
- instead of reform, technological “fixes”

The Solution:

- urgent but possible
- accept that water is both a public resource and private property
- combine command-and-control model of government rules and regulations, with market forces of transferable rights and price incentives
    - restrict pumping: break cycle of unlimited access
    - require conservation
    - facilitate water transfers from low value to higher value uses
    - recognize the economic value of water resources by increasing water rates